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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/737,542	12/14/2000	Robin R. Miles	IL-10406	9714

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EXAMINER

PADMANABHAN, KARTIC

ART UNIT	PAPER NUMBER
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1641

DATE MAILED: 06/17/2003

18

Please find below and/or attached an Office communication concerning this application or proceeding.

**Office Action Summary**

Application No.

09/737,542

Applicant(s)

MILES ET AL.

Examiner

Kartic Padmanabhan

Art Unit

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --  
**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 31 March 2003.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 10-28 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 10-28 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on \_\_\_\_\_ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

**Priority under 35 U.S.C. §§ 119 and 120**

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
  - ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

**Attachment(s)**

- 1) ☒ Notice of References Cited (PTO-892) 4) ☐ Interview Summary (PTO-413) Paper No(s). \_\_\_\_\_
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948) 5) ☐ Notice of Informal Patent Application (PTO-152)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) \_\_\_\_\_ 6) ☐ Other: \_\_\_\_\_

## DETAILED ACTION

### *Claim Rejections - 35 USC § 103*

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

3. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

4. Claims 10, 12-18, and 21-28 are rejected under 35 U.S.C. 103(a) as being unpatentable over Van Gerwen et al. (WO 97/21094).

Van Gerwen et al. teach an impedimetric detection system comprising an insulating layer with a plurality of interspersed channels therein. A metal coating is applied to one of the two opposite side walls of each channel and on top of the dielectric layer in between said channels, thereby forming an impedimetric device. Probes are applied to either the insulating part of the channels or to the surface of the electrodes or both (abstract). The device also comprises means for applying a voltage on the metal coatings and measuring the impedance between the electrodes. The sensor of the reference also has an interdigitated electrode structure (page 10, lines 10-16 and page 15, line 28). The probes of the device include antibodies (page 5 and figures 1-7). When an electric signal is applied (voltage or current), an electric field arises. If the analyte is present in the solution tested, it will be bound to the probe on the electrode surface, resulting in a change in impedance, which is then quantified (page 15). It is inherent that the means for producing the electric field is an AC or DC power supply. However, the reference does not teach pairs of electrodes located on the same surface and/or same side of the microchannel or on a bottom surface of the channel.

It would have been *prima facie* obvious to one of ordinary skill in the art at the time of the invention to place the electrode pair on the same side of the microchannel, since it has been held that rearranging parts of an invention involves only routine skill in the art. *In re Japikse*, 86 USPQ 70. In addition, the placement of the electrodes on a bottom surface of the microchannel would have been obvious because it simply represents an optimization of the device or a rearrangement of the parts of the device, which one would have had a reasonable expectation of success in using.

5. Claims 10, 12-13, 16, and 20-26 are rejected under 35 U.S.C. 103(a) as being unpatentable over Clark et al. (US Pat. 5,194,133) in view of Kipling et al. (US Pat. 5,374,521).

Clark et al. teach sensor devices comprising pairs of sensing electrodes that are spaced apart along the walls of a channel that has been micromachined in a surface of a substrate (abstract). The channel walls may be coated with a biological substance, such as an enzyme (col. 1). The electrodes may be amperometric enzyme electrodes (Col. 3, lines 48-50). The sensors of the reference may be used to measure impedance between electrodes (col. 5, lines 50-55). A DC pulse may be used generate the electric field (col. 5, lines 60-65). The reference also teaches a plurality of signal generators and a plurality of amplifier/mixer assemblies (Figure 6). The reference does not teach antibodies located on the electrodes.

Kipling et al. teach a sensor comprising a pair of spaced electrodes that may both have a coating attached thereto (col. 1). A receptor will be attached to the coating on the electrodes, and the receptor may any biomolecule, including antibodies (col. 5). A voltage is applied between the electrodes, which makes it inherent that there is a means for applying this voltage to create an electric field (col. 3). The impedance between the electrodes is one of the parameters that can be determined with the sensor of the reference (col. 5). It is further inherent that the electric field is produced by an AC or DC power supply because these power supplies are generally used to apply voltages at various frequencies.

It would have been *prima facie* obvious to one of ordinary skill in the art at the time of the invention to use the antibodies on the surfaces of the electrode as taught by Kipling et al. with the device of Clark et al. because Kipling teaches that any number of biomolecules can be used on the electrode surface. Therefore, depending on the analyte one wishes to detect, one would have known that a number of receptors could have been placed on the electrodes of Clark et al. with a reasonable expectation of success. In addition, it would have been *prima facie* obvious to one of ordinary skill in the art at the time of the invention to place the electrode pair

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on the same side of the microchannel, since it has been held that rearranging parts of an invention involves only routine skill in the art. *In re Japikse*, 86 USPQ 70. Also, the placement of the electrodes on a bottom surface of the microchannel would have been obvious because it simply represents an optimization of the device or a rearrangement of the parts of the device, which one would have had a reasonable expectation of success in using.

6. Claims 11, 14, 17-19, and 27-28 are rejected under 35 U.S.C. 103(a) as being unpatentable over Clark et al. (US Pat. 5,194,133) in view of Kipling et al. (US Pat. 5,374,521) as applied to claims 10, 12-13, 16, and 20-21 above, and further in view of Taylor et al. (US Pat. 5,001,048).

Clark et al. and Kipling et al. teach sensor devices, as discussed above. However, the references do not teach the use of reference electrodes or an interdigitated electrode assembly.

Taylor et al. teach an electrical biosensor for analyte determination. In one embodiment, a single chip design is used, wherein the transducer is a quartz or glass substrate containing two terminal interdigitated electrodes. A receptor (which may be an antibody) containing membrane is in contact with the electrodes. A current is applied across the electrodes creating an electric field, such that a change in impedance results upon binding of an analyte to its receptor. The impedance is measured and is indicative of analyte concentration in the sample. In another embodiment, a double chip design may be used. This biosensor includes a non-receptor (reference) membrane and a receptor containing membrane, wherein the membranes are attached to different electrode surfaces, and impedance measured from control membrane is considered as a background signal. A barrier, which may be comprised of an insulator, is located between the reference and receptor-containing electrode to inhibit current flow between the two surfaces. It is once again inherent that the power supply is AC or DC.

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It would have been *prima facie* obvious to one of ordinary skill in the art at the time of the invention to use the reference electrodes and insulating layer, as well as the interdigitated electrode assembly of Taylor et al. with the modified sensor of Clark et al. and Kipling et al. One would have been motivated to use a reference electrode in an insulating layer to determine a background signal, wherein a difference from background can be used as an indication of the analyte of interest. Further, an insulator provides the advantage of preventing current flow between the reference electrode and sensor electrode, which results in a contamination of assay results. It would have also been obvious to use an interdigitated electrode assembly because Clark et al. state that a number of electrode configurations can be used with the device of their reference. Further, the configuration depicted in figure 4 of the reference resembles an interdigitated assembly, and one would expect such a configuration to work with their sensor.

7. Claim 15 is rejected under 35 U.S.C. 103(a) as being unpatentable over Clark et al. (US Pat. 5,194,133) in view of Kipling et al. (US Pat. 5,374,521) as applied to claims 10, 12-13, 16, and 20-21 above, and further in view of Stetter et al. (US Pat. 5,567,301).

Clark et al. and Kipling et al. teach sensor devices, as discussed above. However, the references do not teach the use of an AC source.

Stetter et al. teach a biosensor comprising two spaced metal electrodes, wherein at least one antibody is disposed on and/or between the two electrodes. The sensor also comprises impedance detection means for measuring the impedance between the two electrodes (cols. 3-4). Since figure 2 shows the impedance as a function of the AC frequency, the presence of an AC power source for the production of an electric field across the electrodes is inherent.

It would have been *prima facie* obvious to use the AC power source of Stetter et al. with the sensor of Clark et al. and Kipling et al. because the use of AC impedance is very well known

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in the art, and one would have known that an AC source could have easily been substituted for the DC source of Clark et al. with a reasonable expectation of success.

8. Claims 11 and 19 are rejected under 35 U.S.C. 103(a) as being unpatentable over van Gerwen et al. (WO 97/21094) as applied to claims 10, 12-18, and 21-28 above, and further in view of Taylor et al. (US Pat. 5,374,521).

Van Gerwen et al. teach a sensor device, as previously discussed. However, the reference does not teach reference electrodes or insulation.

Taylor et al. teach an electrical biosensor for analyte determination. In one embodiment, a single chip design is used, wherein the transducer is a quartz or glass substrate containing two terminal interdigitated electrodes. A receptor (which may be an antibody) containing membrane is in contact with the electrodes. A current is applied across the electrodes creating an electric field, such that a change in impedance results upon binding of an analyte to its receptor. The impedance is measured and is indicative of analyte concentration in the sample. In another embodiment, a double chip design may be used. This biosensor includes a non-receptor (reference) membrane and a receptor containing membrane, wherein the membranes are attached to different electrode surfaces, and impedance measured from control membrane is considered as a background signal. A barrier, which may be comprised of an insulator, is located between the reference and receptor-containing electrode to inhibit current flow between the two surfaces. It is once again inherent that the power supply is AC or DC.

It would have been *prima facie* obvious to one of ordinary skill in the art at the time of the invention to use the reference electrodes and insulating layer of Taylor et al. with the sensor of van Gerwen et al. because the use of a reference electrode in an insulating layer allows the determination of a background signal, wherein a difference from background can be used as an



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indication of the analyte of interest. Further, an insulator provides the advantage of preventing current flow between the reference electrode and sensor electrode, which results in a contamination of assay results.

***Response to Arguments***

9. Applicant's arguments filed March 31, 2003 have been fully considered but they are not persuasive.

10. Applicant argues that the van Gerwen reference does not teach placement of the electrodes on a bottom surface of the channel. However, the examiner maintains that such an arrangement is merely an optimization of the device and does not patentably distinguish the present invention over the prior art. Applicant also argues that it is not obvious to rearrange the electrodes of van Gerwen to place them on the same side of a microchannel because it is not a mere rearrangement of part as in In re Japikse; however, applicant simply makes this conclusion without any rationale or form of support for this position. A simple conclusion without any basis in fact or law is prima facie unconvincing. Although the examiner has not cited art for the specific arrangement of electrodes claimed in the present invention, the examiner notes that art is not necessary when the knowledge for the proposed modification is generally available to one of ordinary skill in the art, which knowledge the court in In re Japikse has held to be available for rearrangement of parts of a device.

11. Applicant's arguments regarding the combination of the Clark and Kipling references is based on the position that this combination does not teach electrode pairs on the same side and/or surface of a microchannel, a position which is acquiesced to; however, the examiner maintains that such an arrangement would have been obvious in light of the relevant case law cited above. The placement of the electrodes on a bottom surface of the channel is also deemed obvious, for

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reasons discussed above. Once again, applicant has simply concluded that the arrangement of electrodes in the present invention is not obvious over the references and In re Japikse is inapplicable here, but has not provided any rationale or form of support for this position. A simple conclusion without any basis in fact or law is prima facie unconvincing. Although the examiner has not cited art for the specific arrangement of electrodes claimed in the present invention, the examiner notes that art is not necessary when the knowledge for the proposed modification is generally available to one of ordinary skill in the art, which knowledge the court in In re Japikse has held to be available for rearrangement of parts of a device.

12. Applicant's arguments with respect to the other outstanding rejections under 35 USC 103 are based on the premise that the van Gerwen reference does not qualify as a proper 103 reference and that the combination of Clark and Kipling do not form the basis of a proper 103 rejection, positions which have been previously addressed and rejected.

### ***Conclusion***

Claims 10-28 are rejected.

References: Oyama et al. and Krulevitch et al. are cited as art of interest for teaching sensors comprising channels and electrode pairs.

**THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37

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CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Kartic Padmanabhan whose telephone number is 703-305-0509. The examiner can normally be reached on M-F (8:30-5:00).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Long Le can be reached on 703-305-3399. The fax phone numbers for the organization where this application or proceeding is assigned are 703-746-5207 for regular communications and 703-305-3014 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0196.

Kartic Padmanabhan  
Patent Examiner  
Art Unit 1641

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June 15, 2003

  
LONG V. LE  
SUPERVISORY PATENT EXAMINER  
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06/16/03